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DR. LAUDER BRUNTON'S "PHARMACOLOGY"

A Text-Book of Pharmacology, Therapeutics, and Materia Medica. By T. Lauder Brunton, M.D., D.Sc., F.R.S., &c. Pp. 1139. (London: Macmillan and Co., 1885.)

IT is nearly twenty years since Dr. Brunton, then a student in the University of Edinburgh, commenced, by his researches on the physiological action of digitalis, which were followed soon after by others on nitrite of amyl, a life of laborious work which has been marked at every stage by contributions which testify to his scientific acumen and his burning love for research, and which have enriched physiology and many branches of medicine with newly-discovered facts.

Now, when the second decade of his professional life is drawing to a close, he presents us with a work which stamps him as a teacher in the highest sense of the word.

It may appear to some that an apology is needed for introducing into the columns of NATURE a review of a work dealing with departments of medicine. To any such we would reply that it falls within the scope of this journal to review the progress of all departments of natural science, and that large sections of Dr. Brunton's book are full of interest to all biologists, and almost as much to the specialised physiologist as to the practical physician.

By the term "materia medica" it has long been the custom to designate the study of the agents, whether derived from the mineral, vegetable, or animal kingdoms, which are employed in the treatment of disease. By "therapeutics" we understand the study of the application of these remedial agents to the cure of disease. Until very recently the study of therapeutics was based entirely on pure empiricism, and under conditions where empiricism (*i.e.* experiment), uncontrolled by theory and unassisted by proper methods of observation, could not but yield misleading and contradictory results. The physician employed a drug because others had prescribed it before and found it useful in certain diseases, possessing but rarely any knowledge whatever of the mode in which the drug would affect a healthy subject, or of the manner in which it affected the diseased organism. All that was taught concerning the action of drugs was based upon successive individual experiences, accumulated by individuals who were of necessity destitute of the scientific knowledge, as yet unexisting, which alone could make them "empirics" in the best sense of the word.

These observations are not intended to disparage the work of those who, sometimes possessed of marvellous intuition, worked in bygone days, nor to lead to the inference that old therapeutical experience was barren of useful results. However great the knowledge otherwise acquired of the action of a new drug, however stringent the reasoning which leads us to surmise that it is likely to exert a valuable influence in the treatment of disease, yet ultimately it is by a rational empiricism—*i.e.* by a rational and cautious series of observations on actual cases of disease—that its value will be determined; and, further, he alone will be worthy of the name of a good physician who, irrespective of theoretical considerations, bases his use of remedial agents on the results of rational empiricism. To the older therapeutic studies we owe our knowledge of the usefulness of such drugs as iron, cinchona, and digitalis, a statement which of itself is sufficient to express our obligations to the empiricism of bygone days.

There were many causes which, until lately, stood in the way of a proper study of therapeutics. It was only when the natural history of disease came to be studied by men imbued with physiological knowledge and furnished with all the appliances which physiology has borrowed from chemistry and practical physics that it became possible to lay the foundations of sound therapeutics. From such studies it appears that a morbid process is not to be looked upon as a morbid entity to be destroyed, but usually as the resultant of complex deviations in physiological processes; often, it is true, associated with structural alterations of particular organs which stand more or less closely in the relation of proximate causes of the diseased phenomena. They have shown that, in general, in the treatment of disease, the scope of the physician must be to combat particular phenomena by the use of agents affecting specially the organ and function which are the principal factors in the production of the morbid process.

In order, then, to place medicine on a proper basis, it was needed (1) that the functions of the healthy organism (*physiology*) should be studied in the full light afforded by anatomy, chemistry, and natural philosophy; (2) that the exact deviations of the several functions from the normal standard which constitute particular diseases should be ascertained with the utmost exactitude, not only so as to permit of accurate recognition (*diagnosis*) and classification, but to furnish the elements for a philosophical treatment; (3) that alterations induced in the structure of organs by disease (*pathological anatomy*) should be minutely observed, and that by the light of *experimental pathology*, the course of these alterations and, if possible, their proximate as well as their more remote causes should be ascertained; (4) that the so-called physiological action of drugs and other remedial agents should be submitted to a searching investigation: to this study the vague and misleading term of *pharmacology*, previously employed by German writers, has, unfortunately as we think, been applied; (5) that the subsequent application of drugs and other remedial agents to treatment (*therapeutics*) should be studied not only with the object of showing their influence on particular diseases, but also the way in which individual phenomena of disease have been modified.

All the above branches of inquiry are now being pursued by men imbued with the scientific spirit and furnished with all the scientific knowledge of the day. As a result, in spite of the great difficulty of the task, the physician is acquiring more and more that power of anticipating and predicting events which springs out of a knowledge of principles and distinguishes science from mere empiricism.

Until a comparatively recent period the study of the physiological action of drugs and consequently of therapeutics remained in a backward condition, which

contrasted unfavourably with that of other departments of medicine. The researches of Claude Bernard on carbonic oxide and curare were the first fruits of the application of physiology to the elucidation of the action of agents capable of modifying in a definite manner the functions of the body, and opened up the path which others were to follow. Thanks to the researches of such men as Schmiedeberg, T. R. Fraser, Sidney Ringer, and our author, the representatives of a host of active and successful workers, facts have been amassed, and the prospect is daily becoming clearer of the time when the physician shall rely less and less upon mere unsupported experience, and will be guided, as by an unerring compass, in the treatment of the diseases which come under his care. We realise as we read the fine work which lies before us how much has been done in a comparatively short time; we cannot help recognising that this very work places us on a higher platform than before, and thereby gives us a wider prospect towards all points of the compass. Yet we reflect and admit that at present we have only the title-deeds of the estate. We need still to go forth to possess the land.

Dr. Brunton's book contains an enormous amount of information. It is a work which will satisfy alike the student and the expert. Clear and logical it stimulates the student by constant reference to his previous work, and compels the expert to acknowledge that the whole bibliography of the subject has been ransacked to supply the innumerable facts which are so skilfully interwoven with the results of the author's own experience.

The book is divided into six sections. The first, entitled "General Pharmacology and Therapeutics," occupies nearly half the volume. It is a successful attempt to press the most recent and often apparently most abstract conclusions of science into the service of medicine. At the very outset the reader is surprised to find himself confronted with such questions as the unity of matter, Mendeljeff's law, chemical constitution and isomorphism, all placed in more or less direct relationship to pharmacology. It is a specimen of what must be expected throughout this section. Varied scientific facts are reproduced for the sake of overburdened memories, and then in a few pregnant sentences the author connects them with his subject, and, between the lines, opens out new avenues of research.

We would draw special attention to the remark of the author on the object, value, conditions, and objections to the study of experimental pharmacology (pp. 37-41). In the ordinary administration of any drug the difficulties in the way of a correct conclusion as to its action on the system are extremely great. The conditions are so complex that the most experienced physician will often hesitate between the "post" and the "propter." We must by experiment diminish the number of coincident phenomena in order that we may link the right antecedent and consequent. This may be accomplished in various ways, as the author indicates. A simpler organism and one more open to direct investigation may be employed; an organ or tissue may be isolated from the rest of the body, *e.g.* a muscle-nerve preparation; by ligature of blood-vessels, or otherwise, the drug may be excluded from part or parts of the body, and so comparisons instituted; or the normal mechanism of a part may be modified in a definite manner, and the action of the drug examined under these circumstances, as in experiments on drugs affecting the organs of circulation, and in which the vagus is cut or stimulated. Pharmacology is based on experiments thus made, and no one who reads Dr. Brunton's book can doubt their value. The observations of the author on objections to experiments appear to us so just that we cannot avoid reproducing them :—

"*Objections to Experiment.*—Some people object entirely to experiments upon animals. They do this chiefly on two grounds. The first is that such experiments are useless, and the second, that even if they were useful, we have no right to inflict pain upon animals.

"The first objection is due to ignorance. Almost all our exact knowledge of the action of drugs on the various organs of the body, as well as the physiological functions of these organisms themselves, has been obtained by experiments on animals.

"Their second objection is one which, if pushed to its utmost limits and steadily carried out, would soon drive man off the face of the earth.

"The struggle for existence is constantly going on, not only between man and man, but between man, the lower animals and plants, and man's very being depends upon his success.

"We kill animals for food. We destroy them when they are dangerous like the tiger or cobra, or destructive like the rat or mouse. We oblige them to work for us, for no reward but their food; and we urge them on by whip and spur when they are unwilling or flag. No one would think of blaming the messenger who should apply whip and spur to bring a reprieve, and thus save the life of a human being about to die on the scaffold, even although his horse should die under him at the end of the journey. Humane people will give an extra shilling to a cabman in order that they may catch the train which will take them to soothe the dying moments of a friend without regarding the consequences to the cab-horse. Yet if one-tenth of the suffering which the horse has to endure in either of the cases just mentioned were to be inflicted by a physiologist in order to obtain the knowledge which would help to relieve the suffering and lengthen the life, not of one human being only, but of thousands, many persons would exclaim against him. Such objections as these are due either to want of knowledge or want of thought on the part of people who make them. They either do not know the benefits which medicine derives from experiment, or they thoughtlessly (sometimes, perhaps, wilfully) ignore the evidence regarding the utility of experiment."

As protoplasm is the physical basis of life and the cell its unit, Dr. Brunton commences Pharmacology with the action of drugs on amœbæ, white corpuscles, infusoria, and the various forms of specialised protoplasm found in the higher animals. A section is also devoted to micro-organisms. The late extensive corroboration of the truth of the germ theory of disease throws special interest around the investigations which deal with their life-history and the manner in which they are affected by drugs. A short chapter on the pharmacology of the Invertebrata serves to reveal the comparative poverty of our knowledge in this branch, and suggests further inquiry.

We must pass over the elaborate and lengthy chapters on physiology, pharmacology, and pathology as applied to the various organs and systems of the body. It is the centrepiece of the book, and reveals the versatility, the learning and the scientific instincts of the writer.

Section II., entitled "General Pharmacy," contains a

succinct account of the various classes of pharmaceutical preparations, with tables of doses of the individual members of each.

The rest of the book is chiefly taken up with an account of the preparation, characters, doses, actions, and uses of the various remedial agents. Here we find all that valuable empirical knowledge of the use of drugs which science has so far failed to analyse, but which in course of time will no doubt be incorporated with the first section. Section III. is concerned with the inorganic remedies, Section V. with those obtained from plants, and Section VI. with those derived from animals. Section IV., "Organic Materia Medica," requires special notice. It includes all the carbon compounds employed in medicine which are obtained by synthesis.

Pharmacology owes much to the enterprise of the chemist. In the first place, the extraction of definite active principles from the various vegetable structures used in the Pharmacopœia has been of inestimable value. It was formerly impossible to be sure that the preparations made year by year were of the same strength. The environment of the plant varies more or less each season, so that at one time it may manufacture more of its active principles than at another. Moreover some plants contain several powerful ingredients which are of more value apart than together. The extraction and isolation of these substances has therefore led to a correct dosage and their more definite application to the treatment of disease.

In the second place the chemist is making us by degrees independent of the plant world by producing synthetically the bodies thus isolated. Just as the manufacture of alizarine from anthracene made the dyer independent of the madder root, so the artificial production of salicylic acid has supplanted the willow. In course of time, no doubt, as Dr. Brunton suggests, this section of Materia Medica will develop greatly, whilst the number of animal and vegetable preparations will correspondingly diminish. We are not, however—thanks again to chemical research—limited merely to those principles already in the Pharmacopœia. Already we are supplied with a host of substances, the products of synthesis, amongst which many of the valuable drugs of the future will doubtless be found. Organic synthesis, apart from the valuable substances which it may yield us, as the bodies kairin and antipyrin, which have already found their use in medicine, is of extreme importance to the pharmacologist from another standpoint, for it enables him to form conjectures as to the molecular structure of compounds. So far but few definite relations have been established between chemical constitution and physiological action. Still, enough has been done to demonstrate the existence of such relations and to promise a fruitful harvest hereafter. It has been proved, for instance (Crum Brown and Fraser), that the introduction of the methyl group into the molecule of an alkaloid gives it the power of paralysing the end-organs of motor nerves. Similarly Drs. Brunton and Cash have found as a general rule that most of the compound radicals formed by the union of amidogen with the radicals of the marsh-gas series possess a paralysing action on motor nerves.

It is probable that just as in the members of homologous series we have a gradation of physical properties and a similarity of chemical reactions, so bodies having similar chemical constitution will be found to resemble each other in physiological action. Induction will then lead to deduction, and the paths in which we are to tread in order to find drugs endowed with certain properties will be indicated; in illustration of this we note that already we know where to experiment if we wish to add to the number of our anæsthetics and antipyretics.

This review could not well close without a reference to the many useful illustrations and to the elaborate indices (extending to 131 pages), which add materially to the value of the work. It will rank as the text-book on the subjects of which it treats, being at once the best exponent of existing knowledge and a powerful stimulus to further progress. ARTHUR GAMGEE

ELEMENTARY PRACTICAL PHYSICS

Lessons in Elementary Practical Physics. By Balfour Stewart, M.A., LL.D., F.R.S., Professor of Physics Victoria University, the Owens College, Manchester, and W. W. Haldane Gee, Demonstrator and Assistant Lecturer in Physics, the Owens College. Vol. I. (London: Macmillan and Co., 1885.)

IN this the first volume of what will evidently be an elaborate work on practical physics, the authors have treated of general physical processes only, *i.e.* of the methods employed in the laboratory for the exact determination or measurement of the geometrical and mechanical properties of bodies. It is impossible to over-estimate the importance of these fundamental measures, for upon them depends the accuracy of almost all physical work. That this is the view of the authors is made evident by their having devoted nearly the whole of the first volume out of a promised three to matters purely geometrical and mechanical. Throughout the volume the most minute attention to details is apparent, so much so that it is likely to weary those who read it only; but those who use it to guide them in making the measures given will certainly benefit by the completeness with which each subject is treated.

The first chapter, on the measurement of length, may be taken as a type of the whole volume. The metre and the yard are first defined and their absolute relation stated; the actual relation of metre and yard scales—slightly differing from the absolute owing to the fact that 0° C. and 62° F. are the two temperatures of reference—is next explained. A paragraph on "end measure" and "line measure" concludes what is in effect an introduction to the first chapter. Then the "Lessons" in this chapter begin. The first lesson is on the use of scales. In this instructions are given for measuring a length with a pair of compasses and an ordinary or a diagonal scale. Results are given showing the limit of accuracy by this method. The second lesson is on the straight Vernier, the third on the barometer Vernier, the fourth on the spherometer, and the fifth on the micrometer wire gauge. Lesson 6 is a description with figures of the dividing engine of M. Perreaux, the use of which is the subject of the next lesson. The next five lessons of this chapter explain the copying of scales, the cathetometer with its adjustments, the micrometer microscope, the Whitworth measuring machine, the eyepiece and stage micrometer,